

Observations on *Hexabranchnus* from the Australian Great Barrier Reef

(Gastropoda : Opisthobranchia)

BY

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(2 Text figures)

INTRODUCTION

THE SWIMMING DISPLAY of *Hexabranchnus* is one of the most splendid sights a malacologist may hope for. Despite the interest this has aroused there are great gaps in our knowledge of the genus. The normal diet is unknown, for instance, and the taxonomic situation is very confused, with dozens of proposed species. In order to help towards the solution of these problems, the present paper contains a description of the external features and anatomy of Australian specimens, together with notes on the gut contents and the swimming behaviour. These have been compared with observations on *Hexabranchnus* by MORTON (1964: Australia), GOHAR & SOLIMAN (1963: Red Sea), VICENTE (1963: Madagascar) and EDMUNDS (1968: Tanzania). A suggested synonymy concludes the paper.

Miss J. A. Langhorne prepared the drawings for publication.

SOURCE OF MATERIAL

Alive: One specimen, length 21 cm, creeping over coral sand near the reef crest at Heron Island, Capricorn Group, Australian Great Barrier Reef, June 1968. The specimen weighed 334 gr, and the pH of the skin was neutral.

Preserved: Several specimens in the collections of the Queensland Museum and of Miss Isobel Bennett of the University of Sydney.

Other Material: Kodachromes from life of Great Barrier

Reef individuals, kindly given by Mr. D. Henderson and by Dr. L. Harris.

DESCRIPTION

A. External Features (Figures 1 and 2)

The basic colour of the body was rich dark red, with irregular pale mottling. The rhinophoral tentacles were red-brown; the rims of the rudimentary pallial sheaths were bright red, with pale radiating markings. The pedal sole was paler in colour than the rest of the body. The oral tentacles took the form of a pair of flattened lobes (Figure 2C), with frilled edges. The gills, 7 in number, were ample and tripinnate, each being retractile into a separate pallial pit (*i. e.* phanerobranchiate). The gills twitched continuously. Within the ring of gills lay the conspicuous white anal papilla and the nephroproct (Figure 2B).

The colour pattern described above is that which can be seen in the creeping animal. If alarmed, however, the mantle edges are spread out and the animal takes on a vivid aspect, in marked contrast to the well camouflaged resting stage. The unrolling of the mantle margins exhibits the white edges and brilliant purple sub-marginal zones, observable in both dorsal and ventral views. In the dorsal view can be seen an additional feature, where brilliant red radial streaks penetrate the purple zones. There are also approximately bilaterally symmetrical slightly embossed patches of pink surrounding bright red spots; these are partially concealed when the animal is creeping (Figure 2A).



B. Swimming Behaviour

In swimming, the enrolled mantle skirt is spread out, dilated, and strong locomotor waves are propagated rearwards from the anterior pallial margin. The waves are synchronous on the two sides of the body, and each wave takes about 4 seconds to travel its course. Two waves are usually in progress along the sides of the body at any moment. At the same time, the body undergoes great dorso-ventral flexions, a full cycle of activity occupying about 4 seconds. Swimming may continue for many minutes, and it is probable that this is more than a simple escape reaction. Certainly, a brilliant display of colour accompanies the unrolling of the mantle edge, and it may be that swimming here is the behavioural component of an aposematic or warning display. While swimming, the lateral edges of the foot are brought together in order to conceal the sole and the rhinophores are held back against the dorsal mantle.

C. Anatomy

The central nervous system was orange-pink in colour and pustulose like that of a pleurobranchomorph. The blood-gland (of uncertain function) was large and dark red, overlying the pallial nerves behind the nerve ring. A conspicuous pear-shaped gastric caecum was present. The penis was extremely large, 3 cm or more in preservative. The penial sheath was helically coiled around the narrow vas deferens. The penis was unarmed.

The jaws were dark brown, lying one on each side of the oral canal. They exhibited antero-posterior wrinkles and were composed of minute rods of chitin. The radular formula was $48 \times 91 \cdot 0 \cdot 91$. This is somewhat different from Red Sea specimens ($40 \times 60 \cdot 0 \cdot 60$ to $60 \times 78 \cdot 0 \cdot 78$, according to GOHAR & SOLIMAN, 1963). The hooked simple teeth lacked subsidiary denticulations of any kind.

D. Diet

The hindgut was filled with fragments of greenish material which contained minute calcareous spicules. Dr. P. Kott kindly identified these remains as the ascidian *Didemnum moseleyi* Herdman. This is the first record of

such a diet for *Hexabranchnus*. Other authors have identified the gut contents as sponges (YOUNG, 1969), or as foraminiferans, worm-tubes, and gastropod and echinoderm shells (EALES, 1938).

DISCUSSION

Many species of *Hexabranchnus* have been proposed, but as long ago as 1909, ELIOT stated that "It may be doubted whether the species of *Hexabranchnus* are for the most part more than colour varieties". In the following year, this distinguished authority again made it clear that he doubted the validity of nearly all the claimed specific divisions (ELIOT, 1910). Since that time, OSTERGAARD (1955) and MARCUS & MARCUS (1962) have added new proposed species of *Hexabranchnus* but without seriously attempting to distinguish their specimens from previous described species. Indeed, apart from a minor difference in radular morphology, the only important feature distinguishing *H. morsomus* Marcus & Marcus, 1962, from older described forms is the fact that it came from the Virgin Islands in the Atlantic Ocean, whereas other records had been exclusively from the Indo-Pacific. Only in GOHAR & SOLIMAN's (1963) paper is there an attempt to describe and illustrate the variations which may occur in the colour patterns within a particular sea-area. Their results support Eliot's view that there may be only one valid species of *Hexabranchnus*. EDMUNDS (1968) claimed to have detected differences in the swimming behaviour of Tanzanian specimens compared with published accounts of Australian material (MORTON, 1964), but his illustrations do not support this contention. His plate 1 (1) shows two waves on the mantle margin on each side, despite his assertion in the text of his paper that only one is present in Tanzanian material. There are thus no substantial differences either in behaviour or colouration in *Hexabranchnus* recorded from localities all over the Indo-Pacific Basin. The published records probably all refer to a single species. The name *Doris sanguinea* Rüppell & Leuckart, 1828, appears to have priority.

CONCLUSION

List of Principal Synonyms of *Hexabranchnus sanguineus* (Rüppell & Leuckart)

- Doris sanguinea* Rüppell & Leuckart, 1828 (Red Sea)
Hexabranchnus proetextus Ehrenberg, 1831 (Red Sea)
Doris flammulatus Quoy & Gaimard, 1832 ("Ile des Amis")

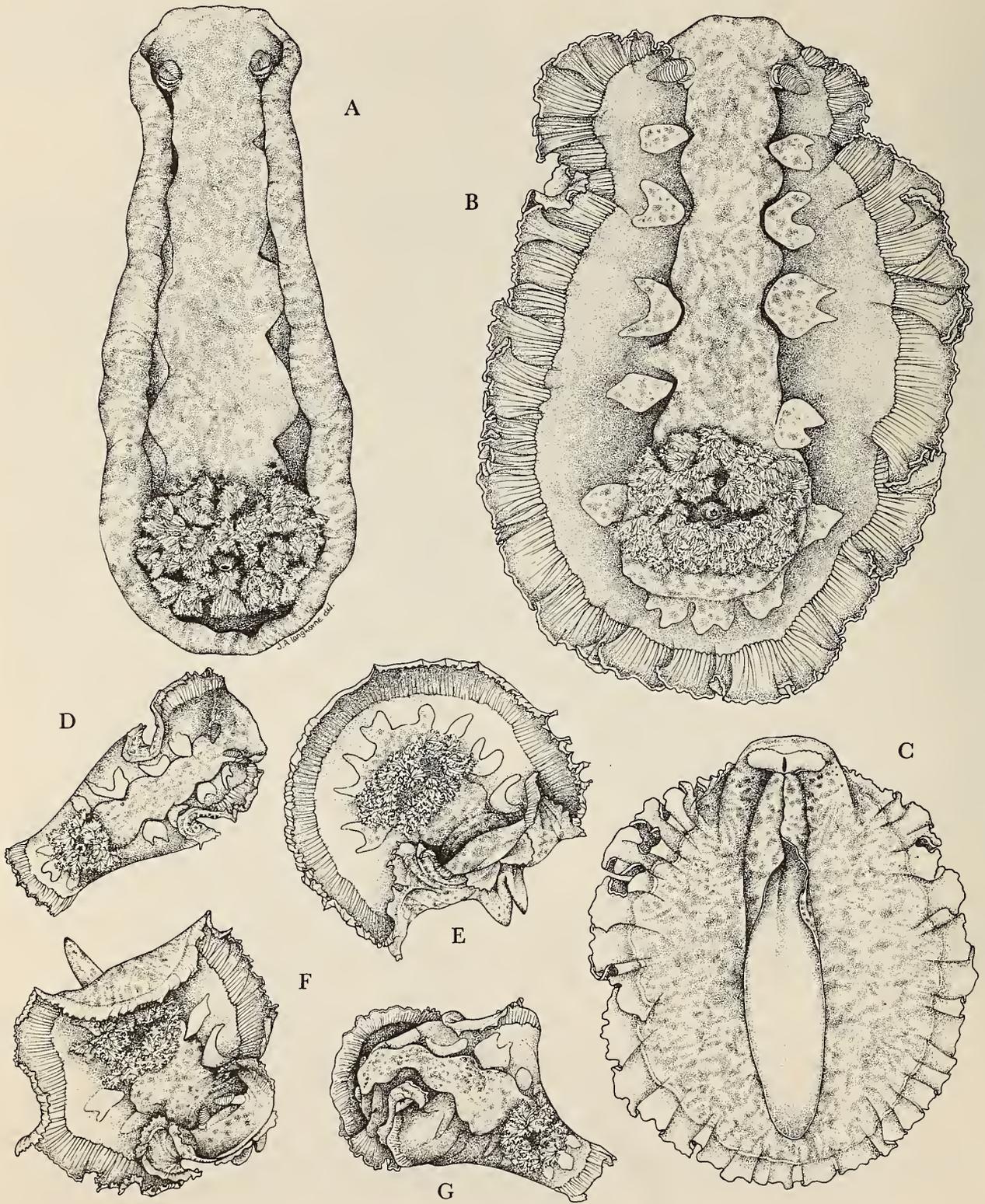
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Figure 1

Hexabranchnus sanguineus

A Swimming vigorously

B The same, creeping over coral debris, Heron Island,
Great Barrier Reef



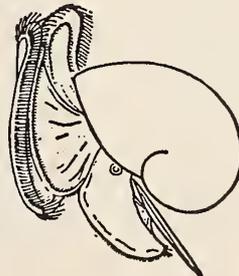
- Doris marginatus* Quoy & Gaimard, 1832 (China, Madagascar, Red Sea, Ryukyu Islands, Japan, Caroline Islands, Marshall Islands, Australia [Great Barrier Reef to Abrolhos Islands], New Caledonia, Hawaii, Tonga, British Solomon Islands, Fiji, Ceylon)
- Doris cardinalis* Gould, 1852 (Hawaii)
- Doris sandwicensis* Eydoux & Souleyet, 1852 (Hawaii)
- Hexabranchnus pulchellus* Pease, 1860 (Hawaii)
- Hexabranchnus pellucidulus* Abraham, 1876 (unknown locality)
- Hexabranchnus suezensis* Abraham, 1876 (Red Sea)
- Hexabranchnus aneitumensis* Abraham, 1877 (New Hebrides)
- Hexabranchnus mauritianus* Abraham, 1877 (Mauritius)
- Hexabranchnus orbicularis* Abraham, 1877 (Mauritius)
- Hexabranchnus aneitus* Bergh, 1878 (Philippines)
- Albania formosa* Collingwood, 1881 (Formosa)
- Hexabranchnus imperialis* Kent, 1897 (Abrolhos Islands)
- Hexabranchnus lacer* Bergh, 1900 (not Cuvier, 1804) (unknown locality)
- Hexabranchnus plicatus* Hägg, 1901 (unknown locality)
- Hexabranchnus digitatus* Eliot, 1906 (Maldiv Islands)
- Hexabranchnus tinkeri* Ostergaard, 1955 (Hawaii)
- Hexabranchnus aureomarginatus* Ostergaard, 1955 (Hawaii)

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Figure 2

Hexabranchnus sanguineus

- A Creeping posture
- B Spread out on a table, dorsal view
- C The same, ventral view
- D - G Various views of the vigorous swimming movements



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